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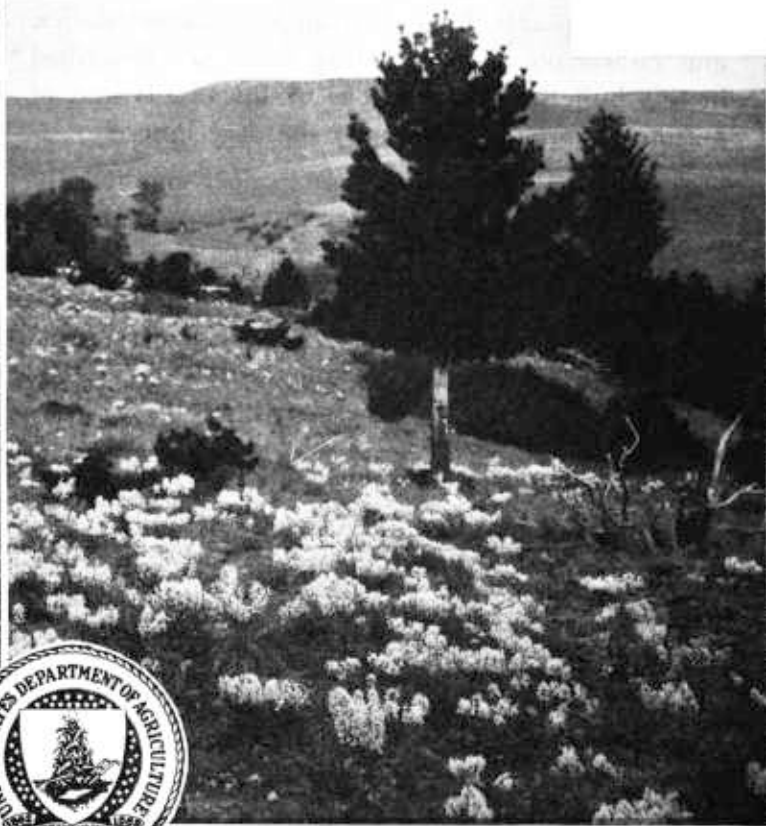
U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1054 *rev.*

June 1929

The LOCO-WEED DISEASE

Rev. ed.
follows



LOCO WEEDS are poisonous plants that have caused heavy losses of horses, cattle, and sheep in some parts of the West and Southwest. Six plants are known definitely to be locoes, a few other related plants are poisonous but do not produce typical loco-weed symptoms, and some suspected ones are harmless.

The loco plants, their distribution, characteristics, and effects on animals eating them are described in this bulletin. Illustrations of the plants and of poisoned animals accompany the descriptions.

Symptoms of poisoning and proper methods of feeding and treating locoed animals are detailed.

It has been proved, both experimentally and by the practical work of stockmen, that the locoes can be destroyed by digging and that the cost of the work is not excessive.

Washington, D. C.

Issued July, 1919
Revised June, 1929

THE LOCO-WEED DISEASE

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EXTENT AND CAUSE OF THE DISEASE

THE word "loco," meaning crazy, is of Spanish origin, and for many years has been applied popularly to a disease common among horses, cattle, and sheep in the Great Plains region of the West. The first printed record of the disease appears to have been in the monthly report of the Commissioner of Agriculture for October, 1873,¹ and the description of the symptoms of locoed animals in that report and in succeeding ones of the United States Department of Agriculture are among the most valuable written.

Losses of horses, especially in parts of Texas and Arizona, have been very large at times, while in some parts of Montana, Colorado, Nebraska, and Kansas, because of the large number that die of the disease, it has been found impossible to run horses freely on the range. The losses of cattle have been heavier, perhaps, in Colorado, than in any other State, while the losses of sheep have occurred more frequently in the States farther north, especially in Montana.

Much investigation, both in the field and in the laboratory, has been undertaken, but the results of the earlier studies were very contradictory. Many people became convinced that while there was a diseased condition among livestock which doubtless caused very heavy losses, it was due to starvation, parasites, or other causes rather than to any specific poisonous effect produced by plants eaten. Most stockmen, however, were convinced that the disease was caused by eating certain plants, which on that account were known to them as "loco plants."

¹ORMSBY, O. B. A POISONOUS CALIFORNIA PLANT. U. S. Dept. Agr. Mo. Rpt. 1873: 503-504. 1873.

LOCO-WEED PLANTS

A large number of plants have been called "loco weeds." Most of those suspected of being poisonous belong to the botanical family Leguminosæ, to which belong also the pea, alfalfa, and similar plants.

Because many leguminous plants found in the arid and semiarid regions of the West closely resemble one another, there is an unfortunate tendency in some regions to class as locoes many plants which are not only harmless but, on the contrary, furnish good forage.

It would be well if the use of the term "loco weed" could be confined to those plants that produce the typical loco symptoms described in this bulletin.

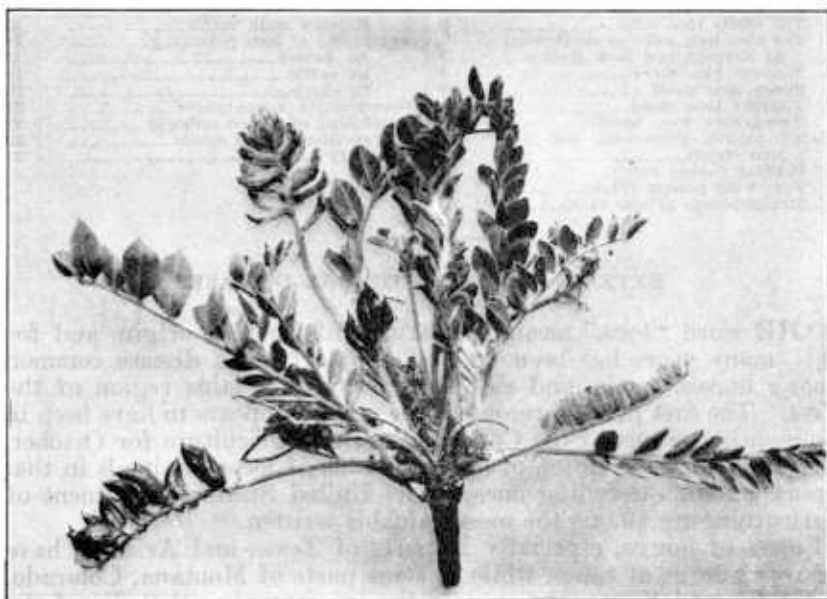


FIGURE 1.—A small plant of the purple, or woolly, loco weed, *Astragalus mollissimus*. This plant is found in the shaded territory of the outline map shown in Figure 2.

Six plants are definitely known to be loco weeds, and there is good reason to suspect others of being poisonous. On the other hand, certain suspected plants have been shown to be harmless. Especially important in the production of losses from loco poisoning are the purple loco, the white loco, and the blue loco.

THE PURPLE LOCO WEED

The purple loco or the woolly loco, sometimes known as the Texas or true loco, is the plant that in the past has been considered the most probable cause of loco poisoning. The scientific name is *Astragalus mollissimus*. A small plant is shown in Figure 1. In northern Texas, western Kansas, or western Nebraska, when one speaks of loco that is the plant ordinarily meant. It is also referred to as the stemmed

loco plant, because it has true stems, whereas the white loco weed is stemless. The pods are two-celled and those of the white loco one-celled.

The purple loco weed is a perennial, growing in patches on adobe soils, in depressions rather than in elevated situations. It rarely grows in the abundance which is characteristic of some of the other so-called loco plants, but patches of it may cover several acres. Under favorable circumstances, where a plant grows for several years, it may become perhaps a foot in height and occupy a space possibly 2 feet in diameter. The flowers are rather inconspicuous, with very deep-purple corollas, and the pods are short, thick, two-celled, and very dark brown. The leaflets are ovate or elliptical and very densely covered with hairs, from which the plant gets its common name, woolly loco. The long branches of the plant are inclined to lie rather close to the ground.

The purple loco-weed plant is found as far north as South Dakota, as far south as Mitchell County, Tex., and Roswell, N. Mex., and as far west as central New Mexico. Its eastern limit may be stated as central Kansas and Nebraska and the western part of Oklahoma. In those regions it grows in varying abundance. It blooms in Colorado about June 1, but farther south, in New Mexico, for instance, blossoms are found early in April. (Fig. 2.)

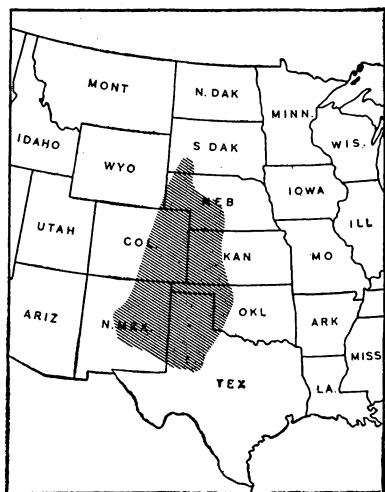


FIGURE 2.—Distribution of the purple loco weed, *Astragalus mollissimus*. A small plant is shown in Figure 1

When the loco investigation was first undertaken by the United States Department of Agriculture there was a general belief among stockmen that the purple (woolly)

loco was a poisonous plant and a less general belief that the white loco weed was injurious. The blue loco weed was generally recognized in the regions where it grew abundantly as a poisonous plant.

Field work carried on during several years has shown clearly that the purple loco weed is rarely injurious to cattle. Where the purple plant is the only loco weed known, the losses from poisoned stock are limited almost exclusively to horses. Apparently, cattle will not eat the plant readily. The experiments show that under ordinary circumstances most cattle would prefer to starve rather than eat purple loco weed. Most horses do not take readily to it unless in the first place they are induced to eat it because of short feed. It has been demonstrated that the so-called loco disease of the Plains is not simply a matter of starvation, as many have supposed, though it is also clear that when other feed is abundant very few horses will eat loco. When, however, because of scarcity of grass, a horse is induced to begin the eating of loco, it is very likely to contract a habit, which leads to continual feeding on the weed, eventually with fatal results.

Under conditions of short feed, the purple loco weed is eaten late in the winter. Because of its great poisonous effect on horses,

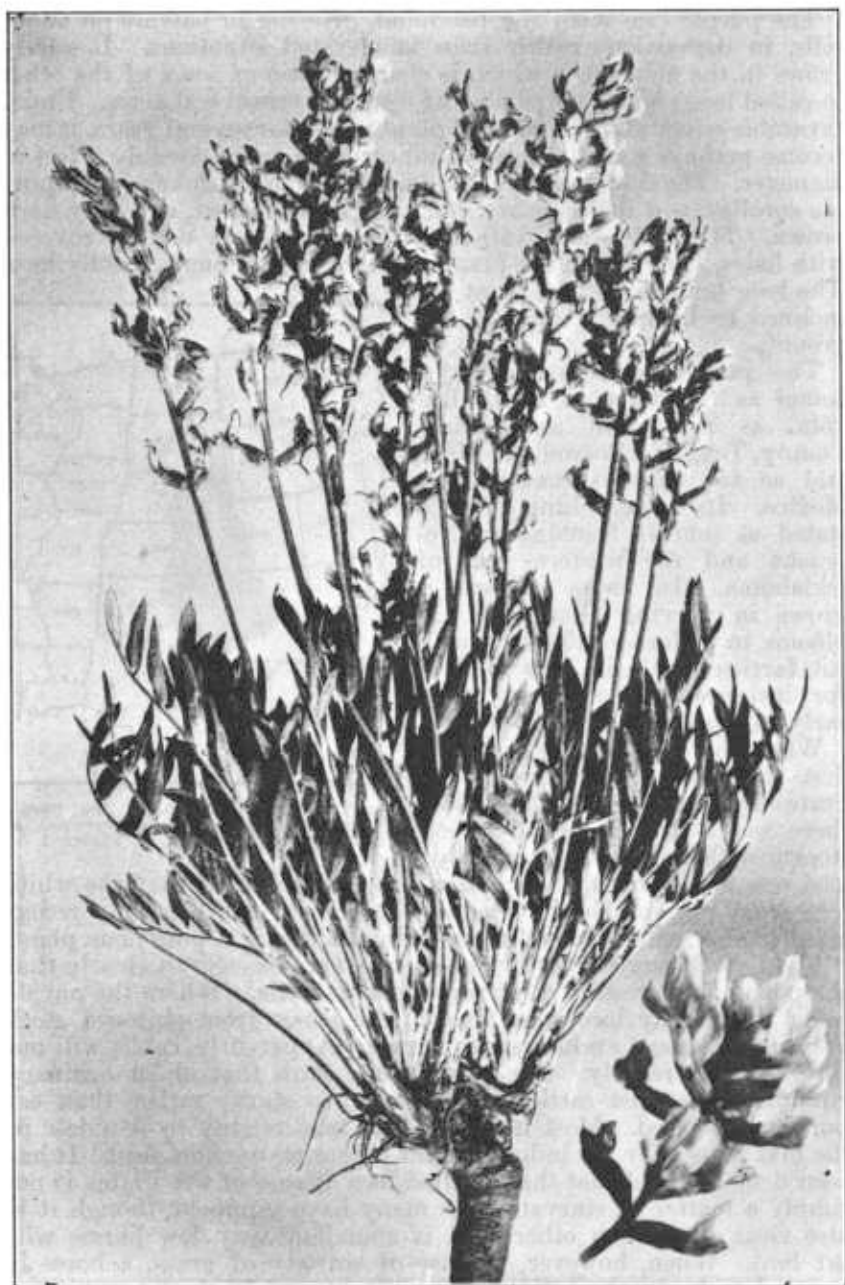


FIGURE 3.—White loco weed, *Oxytropis lambertii*, in bloom. This is much more widely distributed than the other loco plants, as is shown by the shaded portion of the outline map in Figure 4

results may come more quickly than in the case of the other loco plants, and heavy losses sometimes occur in a short time.

THE WHITE LOCO WEED

The white loco-weed plant, *Oxytropis lambertii* (fig. 3) is distinguished from the purple loco weed by its long, lance-shaped leaflets and by the general habit of the plant, which is erect rather than low and spreading. This is the plant commonly known in Wyoming, Montana, and in some parts of Colorado as "the loco." It has no true stem, and on that account is sometimes called the stemless loco. The leaflets are more tapering and not so hairy as those of the purple loco, and are olive green in color.

The flowers ordinarily are on long stems and in the Plains regions are commonly white, although there is considerable variation in their color. Purple flowers are not uncommon. In the mountain regions the white loco ordinarily has very deeply colored flowers, dark shades of violet and purple. It blooms earlier than the purple loco weed. Plants bloom in Colorado in the latter part of April, and early in the summer the flowers and the pods are found on the still erect flower stems. The pods are slender and filled with seeds. When dry they rattle as a person passes through a patch of the plants, making a sound which closely resembles the warning of a rattlesnake. On that account, in some localities, it is known as "rattleweed." Both this plant and the purple loco weed have extremely long roots, growing down from 3 to 6 feet.

Much more widely distributed than the purple loco weed, the white loco weed is found from Saskatchewan and Alberta, and perhaps Yukon, Canada, to Dallas, Tex., and the Chiricahua Mountains in southeastern Arizona; as far east as western Minnesota and western Iowa; and as far west as the Salmon River Mountains, Idaho, Raft River Mountains, Utah, and the San Francisco Mountains, Ariz. (Fig. 4.) It grows largely on slight elevations and on sandy soil, and in some places in very great abundance. In parts of Colorado, Wyoming, and Montana, at the time of blossoming, large areas are as white as though covered with snow, and in the foothill regions of these States the patches of beautiful flowers are very striking.

Oxytropis lambertii goes under the common names of "white loco" and "rattleweed." In the mountains, however, the term white loco sometimes is applied popularly to another leguminous plant. On account of the color of the flowers in the mountains it is also sometimes known as the pink loco.

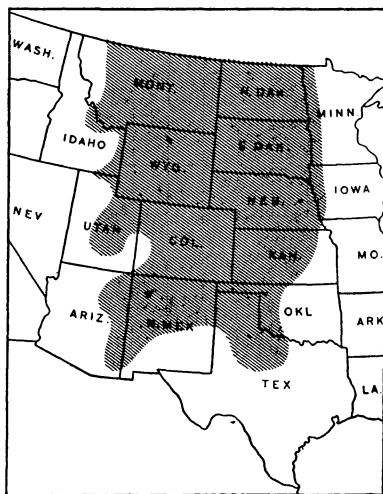


FIGURE 4.—Distribution of the white loco weed, *Oxytropis lambertii*, in the United States. A plant of this species in bloom is shown in Figure 3

In regard to the white loco weed, experiments have shown very clearly that horses, cattle, and sheep will eat it with great readiness, particularly when grass is somewhat scarce. Both the white and the purple loco weeds are green during the winter, when all grass on the plains is dry and brown. They are prominent plants, too, which induces an animal to try them, and because of their succulent character and somewhat pleasant taste, it may continue to eat them. Not only horses but cattle and sheep will eat the white loco

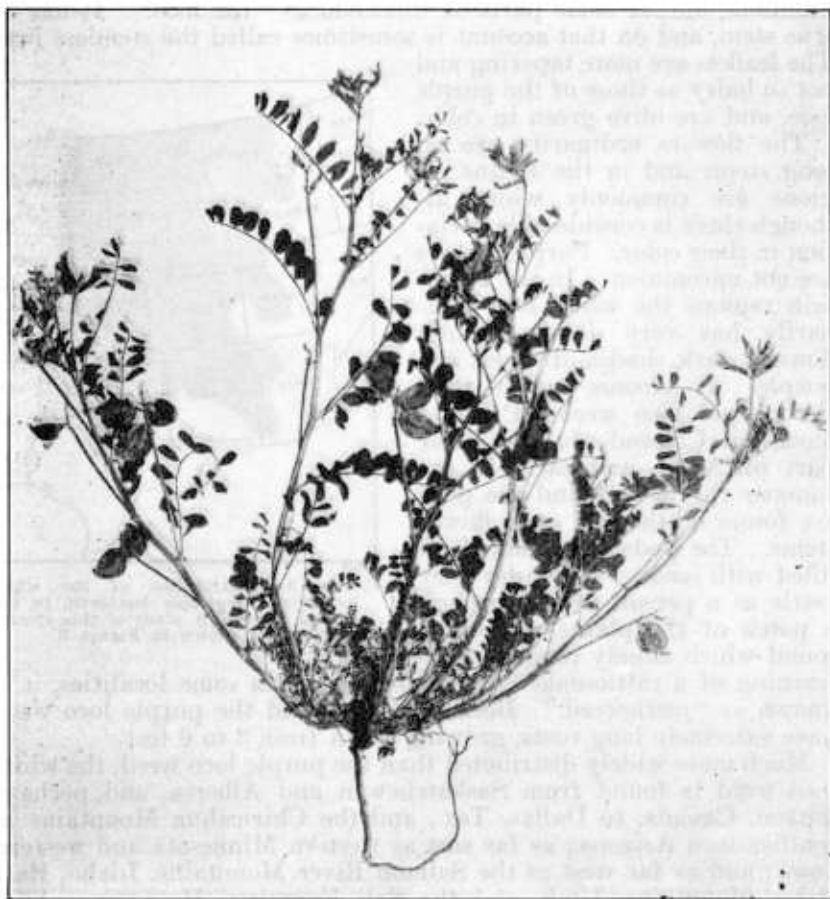


FIGURE 5.—The blue loco weed, *Astragalus diphysus*, showing flowers and pods. This plant is very abundant in parts of Arizona, New Mexico, southern Utah, and southern Nevada

weed, and sometimes even with great avidity. Many animals eat it even when grass is abundant, but it is more common for the habit to be contracted during the fall, winter, and spring, when green grass is scarce. Both horses and cattle eat the white loco readily, but perhaps cattle take to it more readily. During the spring, before the grass starts, where the white loco weed is abundant, practically all animals eat some of it. As the grass becomes more abundant, many of the animals leave the loco weed and eat grass only. These

animals, as a rule, do not seem to be injured by the habit. Others, however, acquire an appetite which is not easily overcome, and will continue to eat the weed even where there is an abundance of other feed. Whether an animal will become locoed or not is then simply a matter dependent on the individual animal. Some cattle and horses eat loco weeds during a part of the year for several years and suffer no harm. Others acquire a habit which leads them to eat the plant almost exclusively and die within a few months or, in some cases, even within a few weeks.

Sheep, also, are poisoned in much the same way as horses and cattle. The effect of the poisoning seems to be peculiarly noticeable on lambs. Frequently they die within two weeks of the time they commence to eat the weed, and without any marked loss of flesh.

THE BLUE LOCO WEED OR "RATTLE-WEED" OF ARIZONA AND NEW MEXICO

In western New Mexico and Arizona a common loco, most generally known as "rattleweed," is the plant known to botanists as *Astragalus diphysus*. (Fig. 5.) It is very different in its appearance from either the white or the purple loco. The leaflets are small, ovate to oblong, and of a deep-green color much like alfalfa. In fact, the plant closely resembles alfalfa in its size, color, and general appearance. The flowers are purple or violet, and on that account it is sometimes called the "blue loco."

The pods are inflated, bladderlike, two-celled, and when immature are streaked with purple.

As shown in Figure 6, the blue loco weed is distinctive of the Southwest and has a somewhat restricted range. It is, perhaps, the most common loco of Arizona and western New Mexico, and is the plant spoken of in that region as "the loco." It extends into southwestern Colorado, southern Utah, Lincoln County, Idaho, and western Nevada, in many places growing in great abundance and covering many acres. It appears in some localities the last of January or early in February, and matures and dries up early in the summer. While the plant is poisonous to cattle and sheep it is especially injurious to horses.

Experimental work shows that the blue loco weed is more poisonous to horses than to sheep, and more poisonous to sheep than to cattle. As compared with the white loco weed it is about equally poisonous to horses, more poisonous to sheep, and about half as poisonous to cattle. When dried it retains its poisonous character, and extensive losses have occurred after the maturity of the plant.

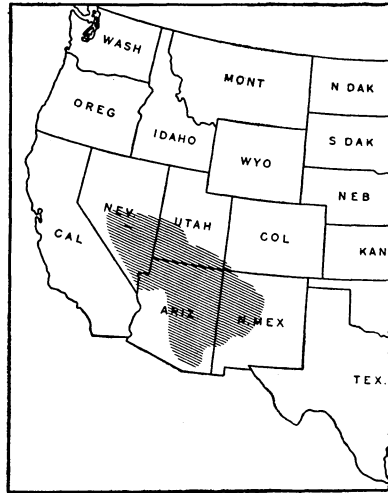


FIGURE 6.—Distribution of the blue loco weed, *Astragalus diphysus*. The plant, with flowers and pods, is shown in Figure 5

WOOTON LOCO WEED

Wooton loco weed, *A. wootoni*, is a common loco of the desert areas of western and southern New Mexico, eastern Arizona, southwestern Texas, and northern Mexico. This species is easily mistaken for the common blue loco weed, Figure 5. However, the pods are larger, more inflated, and one-celled. The leaves are narrower than in the



FIGURE 7.—*Astragalus allochrous*, showing leaves, flowers, and pods

former species and are often covered with a whitish bloom. The plants in habit are spreading, and vigorous plants in a moist soil are often in cushions 3 or 4 feet across and reach a height of 1 foot. With *A. wootoni* is frequently found another species, *A. allochrous*, which resembles *A. wootoni* so closely that many botanists do not consider it as a distinct species. This, shown in Figure 7, is usually found in sandy draws at higher altitudes. The flowers and pods also are larger.

Wooton loco weed is reputed to be especially dangerous to horses, but experimental feedings have shown that it is poisonous to cattle and sheep as well as to horses. It appears to be one of the more poisonous of the loco plants.

SHEEP LOCO WEED

Sheep loco weed, *A. nothoxys* (fig. 8), is found in southeastern Arizona and adjoining Mexico and New Mexico. This plant lies



FIGURE 8.—Sheep loco weed, *Astragalus nothoxys*, showing leaves, flowers, and pods

nearly prostrate, often covering 2 feet in diameter. The flowers are white-tipped or spotted with violet. The pods are narrow and nearly two-celled (partition not quite complete), sharp pointed, and an inch in length. The leaflets are in about six pairs, oval, notched, and nearly smooth. It is abundant in the foothills (from 5,000 to 6,000 feet in altitude) in the Santa Catalina, Santa Rita, Huachuca, and Chiricahua Mountains, and as far north as Mount Graham. Just why this plant should be called sheep loco is not known, for it grows especially

in a country where sheep are not pastured and is thought to cause heavy losses among cattle.

In the experimental feedings of sheep and cattle, it was found to be as poisonous as the common blue loco weed.

THURBER LOCO WEED

Thurber loco weed, *A. thurberi* (fig. 9), is another one of the typical, southwestern loco weeds with a range very similar to



FIGURE 9.—Thurber loco weed, *Astragalus thurberi*. Note the small, pealike pods

that of the sheep loco but extending somewhat farther into New Mexico. It is a close relative of Wootton loco weed and is sometimes found growing in the same localities. Thurber loco weed also makes a large mat on the ground. It is easily distinguished from the other species by the shape of its pods, which are round and inflated, resem-

bling large peas. Growing in pairs on long stems, they are rather conspicuous.

This species has been considered as especially poisonous to horses but has been fed experimentally to cattle and has been found not to differ, materially, in toxicity from *A. wootoni*.

TWO-GROOVE LOCO WEED

Two-groove loco weed, *A. bisulcatus* (fig. 10), ranges from northern New Mexico and the Oklahoma panhandle through central Colo-



FIGURE 10.—Two-groove loco weed, *Astragalus bisulcatus*. Note the drooping, two-grooved pods

rado, Wyoming, western South Dakota, North Dakota, and Montana into Manitoba, Saskatchewan, and Alberta. It is an erect, tall plant, growing to a height of 2 feet, with purple flowers. The pods are two-grooved on the front, and are hairy. The plant is coarse in appearance and has an offensive odor.

In reports by Beath from the Wyoming Agricultural Experiment Station the two-groove loco weed is said to produce typical loco symptoms when eaten by sheep and cattle in moderate quantities during a long period of time, and to produce acute symptoms when eaten in excessive quantities in single feedings. While apparently the plant is poisonous and possibly may be ranked as a loco, there is no reason to think that it occasions any serious losses.

RELATED PLANTS, POISONOUS, BUT NOT LOCO WEEDS

PALLISER POISON VETCH

This Canadian species, *A. palliseri* (fig. 11), sometimes known as *A. campestris*, extends south a short distance in the Cascade Moun-

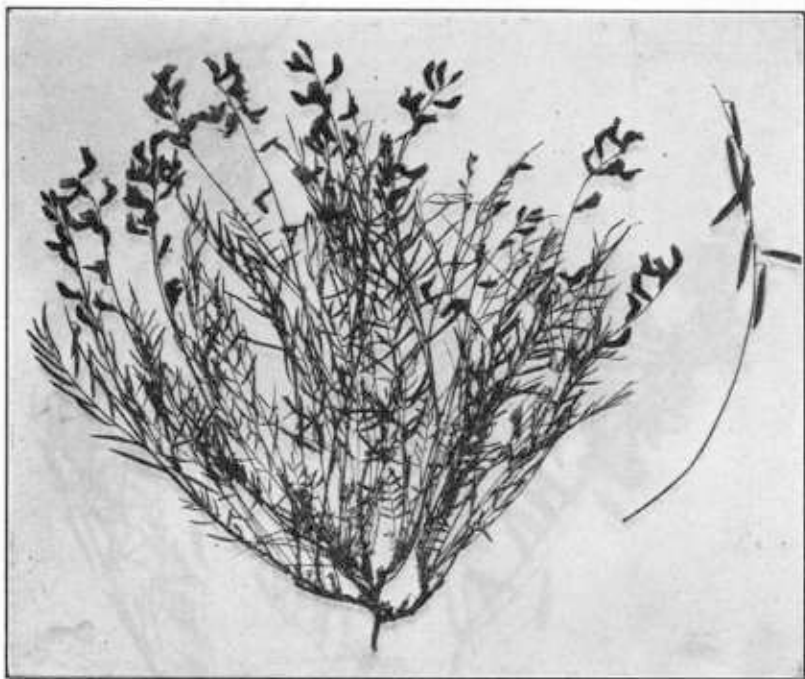


FIGURE 11.—Palliser poison vetch, *Astragalus palliseri*. Reported in British Columbia to be poisonous

tains and to Yellowstone Park in the Rocky Mountains. In Canada it is sometimes called "timber loco." Its stems are extending, sparingly hairy, about 1 foot in height. The leaflets are in from four to nine pairs, narrow, and smooth above. The flowers are purple and the pods linear, one-half inch long, smooth and round in section.

The losses in the United States occasioned by this plant are probably small. It is mentioned here because of the losses in parts of British Columbia reported by Bruce, and the fact that its range extends into the States of Washington, Idaho, and Montana.

The plant is poisonous to all classes of livestock, but lactating females are said to be the most susceptible. The effects are very different from those produced by the true loco weeds. Incoordina-

tion, difficult respiration accompanied with wheezing, whistling, or roaring, and loss of voice in cattle and sheep are said to be the characteristic symptoms.

FOUR-WING POISON VETCH

Four-wing poison vetch, *A. tetraapterus* (fig. 12), is as far as known confined entirely to southwestern Utah and eastern Nevada. The plant is nearly glabrous, and the flowers are white or light purple. The pods are 1 inch in length, one-celled, woody, and have four distinct wings, a form which distinguishes it from the other *Astragali*.

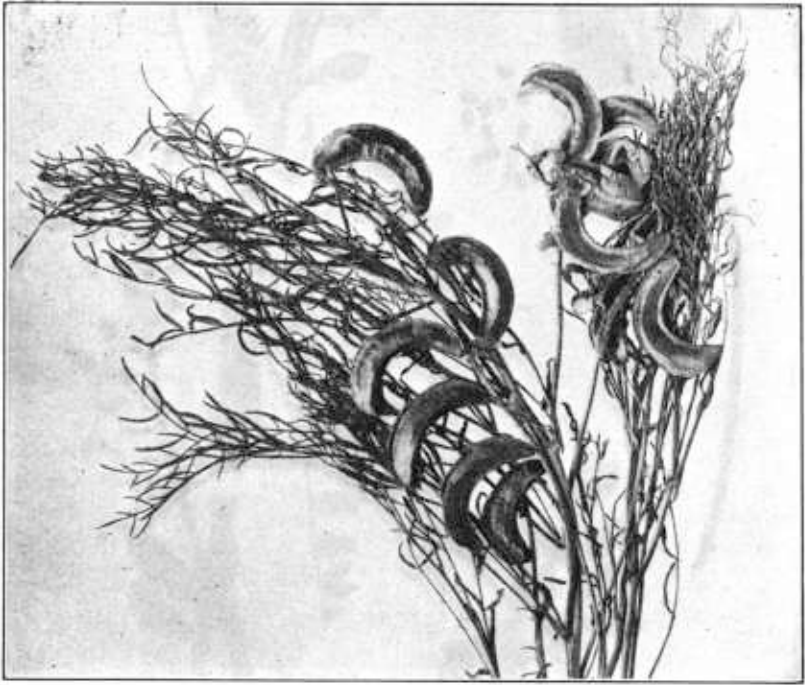


FIGURE 12.—Four-wing poison vetch, *Astragalus tetraapterus*. The form of the pod is characteristic and found in no other *Astragalus*

This *Astragalus* is a distinctly poisonous plant but can hardly be called a loco weed, as the symptoms produced by it are not considered typical of locoism. The principal losses have been in cattle and sheep, although losses of horses have been suspected. The symptoms in the cattle as seen on the range are weakness, with a peculiar, weaving movement of the hind legs in walking. In corral feedings, both cattle and sheep have been poisoned.

STRAIGHT-STEM POISON VETCH

The straight-stem poison vetch, *A. sabulosus*, sometimes known as *A. praelongus* (fig. 13), grows in southwestern Colorado, southern Utah, in the desert regions of eastern California, southeastern Ne-

vada, and south to central New Mexico and Arizona. It is a large, smooth, erect plant, readily recognized by its oval, short-pointed, inch-long, woody, single-celled pods. The leaflets in from 7 to 10



FIGURE 13.—Straight-stem poison vetch, *Astragalus sabulosus*. Reported in New Mexico to be poisonous

pairs are oval and often notched at the end. The flowers are yellowish and in thick clusters.

Reports of poisoning by this plant have been received only from Magdalena, N. Mex., where it has been found to be very poisonous. Feeding experiments have been made with sheep, in which acute symptoms of poisoning were produced.

SUSPECTED PLANTS WHICH ARE NOT LOCO WEEDS

CLOVER MILK VETCH

A great many leguminous plants, suspected of being locoes, are either harmless or, as in some cases, are valuable as forage crops. Their number is so great that it would be impracticable even to list them, but two are so widespread that it is worth while to give a brief description to convince the stockman that he has no reason to fear them.

The plant, clover milk vetch, *Astragalus striatus* (fig. 14), is found abundantly in some regions, sometimes associated with the white loco. It occurs most commonly in the foothill region of the eastern slope of the Rocky Mountains, but sometimes extends into the Plains region. The leaflets resemble, in form, those of the white loco, but are of a deep-green color instead of olive green. The plant is distinguished too by its rather stout stems and the purplish and not very conspicuous flowers, which are in compact heads resembling those of clover. Frequently it is found growing in fairly thick masses in shaded places, like the edges of aspen groves, whereas the white loco grows better in the open. Though *A. striatus* is considered by many as a loco plant, careful experiments have proved its harmless character, and probably it should be classed as one of the desirable forage plants.

The plant shown in Figure 15, Drummond milk vetch, *A. drummondii*, is large and rather coarse, is found from Utah, northern New Mexico, and Nebraska to the Red Deer Hills of northern Alberta. It has yellowish-white flowers, and both the flowers and pods droop from their attachments and by this habit the plant is readily recognized.

This plant has nearly the same range as the 2-groove loco weed and in general appearance closely resembles that species. Both are coarse plants and in both the pods droop in a characteristic way. But the flowers of the 2-groove loco weed are purple, and the pods, as the name indicates, are 2-grooved, while the flowers of *A. drummondii* are yellowish white and the pods are 1-grooved. It is not a loco plant and its coarseness renders it unattractive to grazing animals.

BIGELOW MILK VETCH

Bigelow milk vetch, *A. bigelovii* (fig. 16), grows from the Davis Mountains, Tex., west through Roswell, N. Mex., and the Datil forest region to Grand Canyon, Ariz., and southward into Mexico. The plant resembles in its general characteristics the purple loco weed, *A. mollissimus*, and its leaves resemble those of that species in form, color, and the fact that they are covered with hair. Because of the resemblance it is sometimes known as Texas loco or woolly loco. Besides being a much larger and coarser plant, it can be distinguished from *A. mollissimus* by its pods, which are shorter and are densely woolly, whereas those of the purple loco are smooth and dark brown. It has from 7 to 12 pairs of leaflets, whereas the purple has from 11 to 14 pairs. In both species the pods are two-celled. The Bigelow milk vetch begins to grow in the country where the purple loco weed disappears.

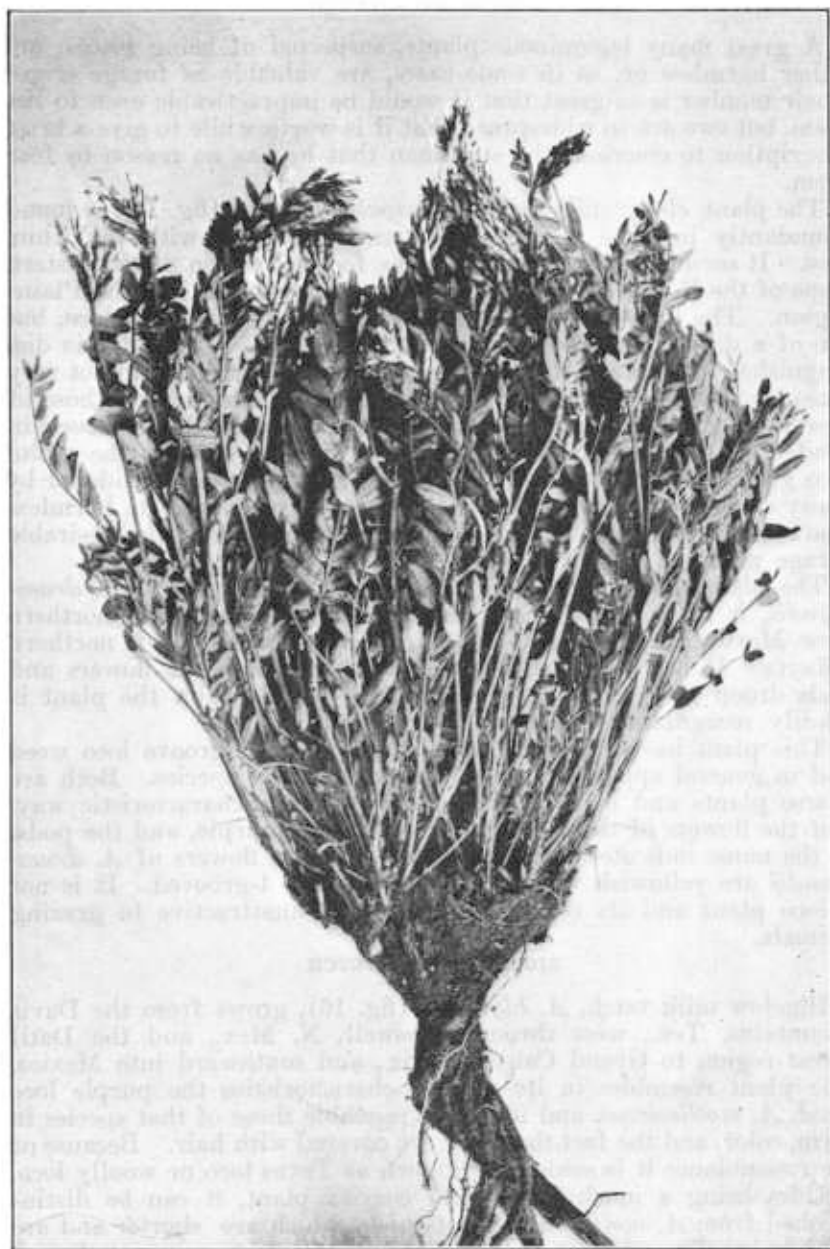


FIGURE 14.—Clover milk vetch, *Astragalus striatus*. This plant resembles the loco plants, but it is not poisonous, though often suspected of being so. It is widely distributed on the eastern slope of the mountains and in the Great Plains region



FIGURE 15.—Drummond milk vetch, *Astragalus drummondii*. This very common plant is frequently called a loco weed, but it is not poisonous. It closely resembles, in form, the 2-groove loco weed but its flowers are yellowish white and its pods are 1-grooved

The purple loco weed produces in animals the typical symptoms which have given the disease its name, but the air-dried Bigelow milk vetch has been fed to cattle in very large quantities without producing loco symptoms or otherwise materially injuring the animals. One heifer was fed with dry material the equivalent of more

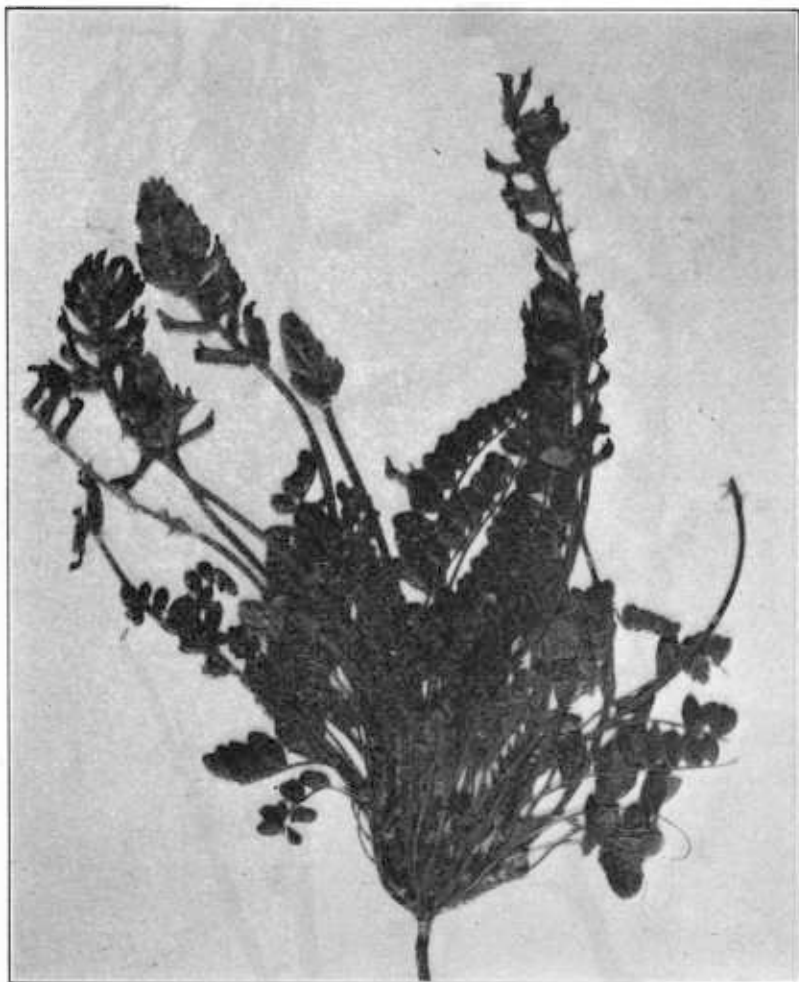


FIGURE 16.—Bigelow milk vetch, *Astragalus bigelovii*. This plant, growing in Texas, New Mexico, and Arizona, resembles the purple loco weed but is much larger and coarser

than three times its weight of the green plant without any ill effects being produced.

SYMPTOMS OF LOCO POISONING

IN HORSES

The first symptom of loco poisoning in horses is often a change in the general condition of the animal. If high-spirited, the animal be-

comes somewhat dull. Following this, irregularities in its gait and in its mode of eating appear. The irregularities in the gait may be due partly to weakness and simulate a paralytic affection. The horse drags its feet more or less; this is particularly noticeable in the hind legs. Associated with this paralytic condition is an apparent loss of normal muscular control. In stepping over a slight obstruction, the horse lifts its feet unnecessarily high, or, in going over a rut in the road, it may leap as if jumping over a ditch.

As the disease progresses, the animal becomes solitary in its habit, and seems to lose very largely its nervous sensibility. If one approaches a badly locoed horse, the latter does not notice the person until within a few feet, when it may suddenly rear and perhaps fall over backward. When it drinks or eats, there is a peculiar, stiff motion of the jaws, showing a lack of control of the muscles. If a locoed horse is used either in riding or driving, the lack of muscular control may make it extremely dangerous, as such a horse shies vio-



FIGURE 17.—A typical locoed horse. Note the abnormal growth of tail and mane, which is characteristic of the disease

lently at imaginary objects, can not readily be led or backed, and if started in motion is inclined to go on in an automatic fashion at the same gait until stopped by some obstruction. In the later stages of the disease, the animal loses flesh, its coat becomes rough, and eventually it ceases to eat and dies. Figure 17 shows a typical locoed horse.

IN CATTLE

The symptoms of locoed cattle are similar to those of locoed horses, the differences being only such as would be expected from the different character of the nervous organization of the animals. There is the same lack of muscular control, and while a steer is not likely to fall over backward, it will start and tremble and perhaps rear and jump backward when suddenly alarmed. A badly locoed steer shows a violently shaking head, particularly after it has become heated. Ordinarily a locoed steer is dull, but under some conditions it may become frantic and run into obstructions in an utterly un-

reasonable way. It is commonly said by stockmen that it is impossible to drive a locoed steer because it is just as likely to run into the driver as in the opposite direction.

Locoed cattle gradually lose flesh, have staring eyes, rough coats, go to water less and less frequently, and eventually die of starvation. A typical locoed steer is shown in Figure 18.

Loco is generally supposed to predispose to abortion, and in locoed herds the calf crop is seriously reduced.

IN SHEEP

The symptoms of poisoning in sheep are not so marked as those in horses and cattle. The lack of muscular control is not so noticeable but still exists. Locoed sheep show, perhaps, more clearly the

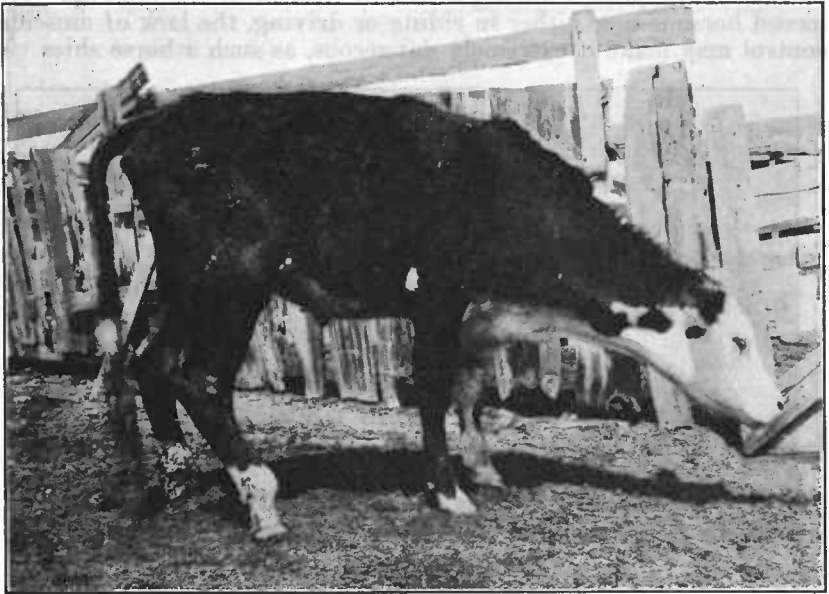


FIGURE 18.—A typical locoed steer. Locoed cattle have rough coats, staring eyes, and, in the last stage, eat and drink very little

weakness which goes with the disease, as they stumble and fall and rise again only with great difficulty. The symptoms of loco poisoning in sheep resemble the symptoms caused by "grub in the head," and at times it is difficult to distinguish between sheep affected by the grub of the sheep gadfly and those poisoned by loco weeds.

Figure 19 shows a typical locoed sheep.

There is considerable difference in the readiness with which various breeds of animals eat loco weeds. It is a matter of common observation on the plains that the so-called native breeds are very much less likely to be locoed than are imported animals. This, of course, is to be expected, from the fact that the imported animals are not familiar with the plants, and in many cases do not have the quality of "rustling," so that they are inclined to eat the feed which is most easily obtained rather than seek more suitable plants. Generally

speaking, the finer breeds of cattle and horses are more likely to be locoed than the poorer breeds. The same thing is true of sheep, it being particularly noticeable that those with black faces are much more apt to be locoed than are the Merinos.

POST-MORTEM APPEARANCES

Post-mortem examinations of locoed animals do not always show clearly marked evidence of the progress of the disease. Since in all cases of fatal poisoning the locoed animals die of starvation, they are profoundly anemic, as would be expected, and as a result accumu-

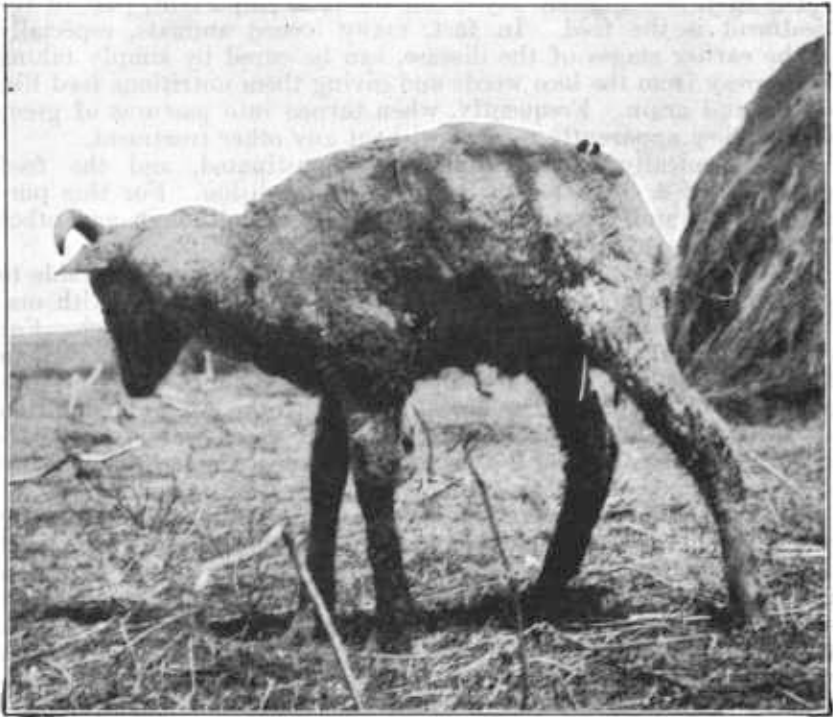


FIGURE 19.—A typical locoed sheep shortly before death

lations of coagulated serum in a gelatinous form are found in various parts of the body, particularly about the heart. There is also an accumulation of coagulated serum in the cavity of the spinal column. This condition almost always exists when the loco poisoning has become chronic. The nervous system is more fully supplied with blood than when the animal is in normal condition.

The poisonous substance in the loco plants produces an irritant effect upon the stomach and intestines, which in most locoed animals results in an inflamed condition of the walls of the stomach. In horses it is common to find ulcers in the stomach near its outlet; in cattle and sheep similar ulcers are found in the fourth stomach.

TREATMENT OF LOCOED ANIMALS

Experiments with substances which would be logical antidotes for loco poisoning have been disappointing, and at the present stage of the investigation there seems to be no reason for hoping that a practical antidote can be found. During the course of the experimental work, however, attempts were made to treat the animals in accordance with the more pronounced symptoms, and the treatment was so successful that it can be said that it is possible to bring most animals out of the locoed condition and restore a large part of their value, provided they are worth enough to warrant a somewhat extended course of treatment.

The first, and without any doubt the most important, part of the treatment is the feed. In fact, many locoed animals, especially in the earlier stages of the disease, can be cured by simply taking them away from the loco weeds and giving them nutritious feed like alfalfa and grain. Frequently, when turned into pastures of green alfalfa, they apparently recover without any other treatment.

All chronically locoed animals are constipated, and the feed should be of a character to remove that condition. For this purpose alfalfa and linseed meal have been used, although any other feed having laxative properties is useful.

When the constipation is obstinate, it has been found desirable to give doses of Epsom salt. The dose used in experiments with mature cattle was about 1 pound, given in the form of a drench. For younger animals the dose was smaller, calves receiving not more than 2 ounces. For horses the dose should be about 8 ounces, and for full-grown sheep 4 ounces. The doses varied with the size and condition of the animal, but commonly rather small doses were found sufficiently effective. It was not necessary to repeat the treatment many times, provided care was taken to give laxative feed.

Many experiments were conducted to determine what remedy would best improve the nervous condition of horses and cattle, and the results seemed to show that for horses nothing was better than arsenic in the form of Fowler's solution, while for cattle the greatest success was obtained by the use of strychnine. Fowler's solution was given in daily doses of from 4 to 6 drams or 20 cubic centimeters in the grain or in the drinking water of the horses. This dose is roughly equal to 4 to 6 teaspoonfuls. It is most conveniently measured out by the use of 4 or 8 dram homeopathic vials. These doses should be continued for a considerable period, the time varying with the individual animal, but ordinarily for not less than one month.

The strychnine was given in hypodermic doses, the cattle being run through a chute and treated one after another. Locoed animals are very sensitive to strychnine, and it was found necessary to give it in extremely small doses. The daily doses should not ordinarily exceed three-twentieths or four-twentieths of a grain or 0.009 to 0.012 of a gram. Large animals may take as much as one-half grain, but that is a maximum dose and often will be found too much. It is well to use one-twentieth grain tablets dissolved in water and insert the needle into the shoulder. The treatment should be continued, as in the case of Fowler's solution, for a considerable time, ordinarily 30 days or more. The fact should be emphasized that the doses of

strychnine should be very small. It was found that animals could be killed very readily with what are considered the common veterinary doses, but in small quantities the results were distinctly beneficial.

It was also found that sodium cacodylate when given to cattle in hypodermic injections of 6 grains, or 0.4 gram, daily, commonly gave beneficial results. The best results, however, were obtained from the use of strychnine and Fowler's solution as already outlined. Badly affected cattle were taken and, after treatment, were turned out in suitable condition to be sold for fat beef, while horses which were absolutely worthless recovered and became entirely usable, although probably they were not in so good condition as they would have been if they had not been poisoned. The experiments show conclusively that most horses or steers can be brought into good condition but they must be valuable to warrant being treated in this way.

The fact should be emphasized that very rapid recoveries can hardly be expected. The condition existing in a case of chronic loco poisoning has been brought about gradually by weeks or months of loco feeding, and the rate of recovery must necessarily be rather slow.

Much can be accomplished in the way of preventing loco poisoning by the proper handling of stock. As already stated, stock commonly contract the habit of loco feeding in times of short feed. Feeding hay during the period prevents many animals from acquiring the habit. On some ranges the loco weeds have a rather definitely limited distribution; in such cases, if kept away from the infested areas until the grass is started, few animals become locoed.

DESTRUCTION OF LOCO WEEDS

A common but erroneous belief among the stockmen of the infested regions is that in order to destroy the loco plants it is necessary to dig up the whole root, so that it has seemed to them almost impossible to clear a field infested with loco, even though the field is small. This impression in regard to the necessity of digging the whole root is false.

Experimental work with the white and purple locoes has shown that if they are cut off below the crown of buds, the plants are killed; there is no danger of sprouts from the roots. It is only necessary to cut the root off 2 or 3 inches below the surface. The seeds of loco plants live for years and all do not germinate in the season following their growth. Consequently, in any field infested with loco, there will be a continuous crop of seedlings, as the seeds germinate under favorable circumstances.

The impression that plants grow from the cut roots probably originated in the fact that seedlings are continually coming up in the immediate vicinity of a parent plant. The seeds of the loco weeds are not provided with any special means of dispersal by the winds. Ordinarily they fall near the parent plant and grow there. Of course the winds which move the dust of the surface carry the seeds from one place to another, but under ordinary circumstances they are not scattered for any considerable distance.

It follows that reseeded from other pieces of ground, even when in the immediate vicinity, is not to be feared. The destruction of loco weeds in pastures is a comparatively easy matter. A man with

a spade can destroy the plants with great rapidity. A few days' work accomplishes much more than one would expect. Because of the seeds which germinate later, it is necessary for the work to be done two or three times during a season, and it must be repeated during succeeding seasons. It has been demonstrated at Hugo, Colo., that the work is not very laborious. The loco-free pasture which was used for experimental purposes was cleared the first year of the experiment by a few days' work, and with very little labor it was kept free from loco during the course of the experimental work. The pasture has been kept under observation for 18 years and very few plants have appeared in that time, showing that it was a fairly permanent job.

Ranchmen in the neighborhood of the Hugo experiment station cleared patches of ground, some of which have been observed repeatedly in the years that have elapsed. Results show clearly that the work has been an economical success and that while some additional cutting has been necessary, the destruction of loco plants has been reasonably permanent. The work by the ranchmen was mostly on the white loco and the station work was on both the white and purple. Generally speaking, it is much easier to dispose of the purple loco, for it grows in limited patches, whereas the white loco may be thickly distributed over many acres.

L. V. Medley, of Magdalena, N. Mex., reports an interesting series of experiments performed by him and his father in cutting out the blue loco weed of New Mexico. In 1906 they dug out a pasture of 80 acres, in which very little loco has appeared since. In 1916 the elder Medley cleared out a pasture of eight sections, in which it was estimated that the loco covered about one-fourth of the pasture. The pasture remained free from loco weed for three years. The men doing the work were required to get at least 2 inches of the root. The work cost nearly \$3 an acre, but it was considered that the money was well spent, as it meant practically a permanent clearing of the land.

Fred Colter, Eagar, Ariz., said in 1920 that in the preceding year he had cleared 12 sections of blue loco weed at a cost of \$100 a section.

If digging out is undertaken, it is evident that the best time is when the plants are in blossom and before the formation of seed. It should be emphasized, too, that while a single cutting is effective, ordinarily it should be followed up by later work to destroy the seedlings which may continue to appear for several years.

SUMMARY

The loco weeds are leguminous plants growing in the arid and semi-arid regions of the West. They cause heavy losses of horses, cattle, and sheep, with characteristic symptoms.

Six distinct kinds of loco plants are known, of which the most important are the white loco weed, *Oxytropis lambertii*, the purple loco weed, *Astragalus mollissimus*, and the blue loco weed, *A. diphysus*. Of these plants the purple affects horses, the blue affects horses primarily but also cattle and sheep, while the white causes heavy losses of all three classes of animals.

The other loco plants may affect cattle, horses, or sheep, if they graze in the areas on which the plants are growing.

Besides the true loco weeds there are three other similar leguminous plants which are known to be poisonous, but they do not produce the symptoms characteristic of loco poisoning.

Locoed animals may recover under careful feeding, but the cure is hastened by the use of Fowler's solution for horses and strychnine for cattle.

The loco weeds may be destroyed by digging, to accomplish which it is necessary to cut the root 2 or 3 inches below the surface of the ground.

In some localities much can be accomplished in the way of preventing loco poisoning by feeding horses, cattle, and sheep during periods of short feed, and by keeping the stock away from infested areas.

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